Deloitte
Haskins+Sells Associates

Management Consultants

EXECUTIVE SUMMARY
A MARKETING AND PRODUCTION PROFILE AND RECOMMENDED STRATEGY FOR DEVELOPMENT OF THE SASKATCHEWAN AQUACULTURE INDUSTRY

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Saskatoon, Saskatchewan
July, 1986

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1. INTRODUCTION

Aquaculture is the husbandry of aquatic organisms, in this case, fish. The terms aquaculture and fish farming are used interchangeably in this study. There are two types of fish farming; they are referred to as "extensive" and "intensive". Intensive modes include rearing fish in cages, tanks or raceways with flow-through or recirculating water supplies. Extensive fish farming is releasing free-roaming fish into a body of water ranging from farm dugouts to ponds to lakes over 30 acres in size on land owned by the farmer as well as bodies of water leased from the Crown. Free - roaming rainbow trout are considered to be superior in quality due to its colourful "rainbow" skin and pink flesh which results from feeding on freshwater shrimp. Saskatchewan has carried on extensive fish farming the last 16 years, but it has gained little prominence in production and sale of fish in comparison to other areas of Canada and to other countries.

The objectives of this study were to develop recommendations with respect to strategic direction and related actions necessary to optimize social and economic benifits in and from Saskatchewan aquaculture development and marketing. To achieve these objectives, the "present situation" of the industry was established by review of past studies, discussions with professionals knowledgeable about the industry, fish farmers, fish hatchery operators, brokers, wholesalers and retail outlets who service the consumer. The collection of information and tabulation of the statistics from Saskatchewan and elsewhere were analyzed with respect to identifying requirements for success and compared to the conditions existing in Saskatchewan. The causes of the gap between the present

situation in Saskatchewan and the conditions for success were identified, and examined to determine the extent to which they represented a constraint to succesful aquaculture in Saskatchewan. Alternative ways of eliminating constraints were examined taking into consideration actions of other jurisdictions to develop successful aquaculture industries, including regulatory matters, production methods, marketing, cost benefit relationships as well as the reality of Saskatchewan's location and the availability of risk/investment capital. From this, the recommended strategic direction and actions for social and economic benefits for the Saskatchewan aquaculture industry were made.

The consultants acknowledge their indebtedness to members of the staffs of the Departments of Fisheries and Oceans and Parks and Renewable Resources as well as the commercial rainbow trout farmers that they were associated with during the course of the study for their patience and co-operation. In particular, the consultants acknowledge Hart Horn, Parks and Renewable Resources, Fisheries Branch for his support and counselling. For this we are grateful.

II. THE ROLE OF GOVERNMENT

Both levels of government are involved in aquaculture and perhaps their respective roles can best be described in terms of research, development and advisory, and regulatory responsibilities.

Federal Role

Nine federal departments or agencies play a role in research and development and advisory services. Of these the Department of Fisheries and Oceans (DRO) is the lead department. Research and development is conducted in various centres throughout Canada, including DFO's Freshwater Institute in Winnipeg. Scientific and disease diagnostic services are provided to industry in many provinces. Federal aquaculture personnel assist in the development of aquaculture across Canada. For the three prairie provinces, there are several part-time positions to deal with this activity.

In addition to its own programs, DFO manages aquaculture related projects under the Program for Industry/Laboratory Projects (PILP) funded by the National Research Council. PILP is aimed at the transfer of federally developed technology to private industry and is currently used to assist an aquaculture waste-heat project at Pickering Ontario adjacent to a nuclear power plant. In 1984-85 approximately $650,000 were awarded across Canada to aquaculture projects under this program.

The Fisheries Development Program delivered by DFO provides funds to assist the industry's development. These funds have been accessed by some provinces. Total program contributions from 1985-86 to 1987-88 will

be $4.4 million. Near-future funding plans for Saskatchewan aquaculture are not anticipated.

DFO also collects statistical information on the fisheries of Canada. There are no data on cultured fish in these reports. Export and import statistics are compiled by Statistics Canada. Again there is no information in these reports specifically on cultured fish.

The remaining federal departments and agencies along with their relevant programs are listed as follows;

- National Research Council (NRC)

  Industrial Research Assistance Program (IRAP) and PILP, previously described. IRAP is a salary support program aimed at increasing industrial research and development through the use of the latest available technology. The Saskatchewan Research Council assisted the development of four private hatcheries through partial funding under this program.

- Department of Supply and Services (DSS)

  The private sector may apply for financial assistance to do research of innovative ideas under the Unsolicited Proposals Program of DSS. Funds dispersed for aquaculture - related projects in 1984-85 exceeded $450,000 for Canada as a whole.

- Natural Sciences and Engineering Research Council of Canada (NSERC)

  NSERC assists aquaculture research projects primarily with grants for operating costs. In this regard, $580,000 was contributed in 1983-84.

- Department of Energy, Mines and Resources (EMR)

EMR administers funds under the National Energy Program through the Office of Energy Research and Development (OERD) and coordinates the Canadian Electrical Association support of the promotion of energy conservation, including a three year project underway involving waste-heat use in each of the three prairie provinces. So far about $50,000 has been spent on this project; the Saskatchewan study involved the Boundary Dam Station at Estevan.

- Science and Technology

Science and Technology sponsors a federal-provincial monitoring committee on aquaculture develpoment under the auspices of the federal-provincial subsidiary agreement on advanced technology.

- Science Council of Canada (SCC)

Their role as an interest group has been to provide funds for projects such as the 1983 National Aquaculture Conference.

- Department of Regional Industrial Expansion (DRIE)

Under its Industrial and Regional Expansion Program (IRDP), DRIE can provide financial assistance to secondary aguaculture activities such as processing. Approximately, $1.1 million was approved for these activities between August 1982 and June 1985. No funds have been dispersed for aquaculture related activities in Saskatchewan as none have been applied for.

- Saskatchewan Indian Agriculture Program (SIAP)

SIAP is funded by the Department of Indian and Northern Affairs. Its mandate includes aquaculture extension services to treaty Indians. In

1985, SIAP was experimenting with rainbow trout cage culture in northern Saskatchewan. Of the funds made available to SIAP, the amount for aquaculture is unknown.

The federal government has issued a new aquaculture policy at the time of writing. Its contents are not analyzed in these pages.

Provincial Role

There are six Saskatchewan government departments and agencies involved in research, development and advisory services.

The Department of Parks and Renewable Resources (DPRR) has since 1985 been the province's official aquaculture lead agency. DPRR has promoted and performed research and has provided technical assistance for aquaculture projects by others. The Fisheries Branch of DPRR provides extension and information services including the provision of informational publications and seminars. They also compile annual provincial statistical data on rainbow trout. As yet however, there are no published statistics on intensive aquaculture in the province.

The remaining government bodies involved in aquaculture are as follows;

- Saskatchewan Research Council (SRC)

  SRC has taken a lead role in the research and development of aquaculture primarily in the area of recirculating fish hatcheries. In addition, they have developed designs for aquaculture facilities, provide courses on aquaculture operations as well as extension services

to those in the industry. SRC estimate their funding for aquaculture research from 1984 to 1986 at $142,000.

- Department of Tourism and Small Business (TSB)

TSB has shown considerable interest in the development of aquaculture in northern Saskatchewan by providing business advice and consulting services to fish farming operations. This department also provides business loans to residents of the Northern Administration District.

- Science and Technology

Since 1984, the Canada - Saskatchewan Subsidiary Agreement on Advanced Technology, the first of its kind in Canada, provides high technology companies and research institutions with funds to assist new process/product development. Emphasis to date has been on high technology ventures. In addition Science and Technology have been the provincial coordinators of the federal-provincial monitoring committee on aquaculture development.

- Advanced Education and Manpower

The Northern Division of this department has been involved in aquaculture training since 1985/86, partly in conjunction with SIAP operations.

The provincial government is also in the process of issuing a new aquaculture policy. A white paper is in development and may be released for public discussion concurrently with this study.

- Aquaculture Regulations

Like other Canadian industries, aquaculture is governed under both federal and provincial statutes and regulations.

The federal government has exclusive legislative jurisdiction over Canada's fisheries in coastal and inland waters. However, administrative responsibilities, including those applicable to aquaculture, have been delegated to some provinces, including Saskatchewan. In Saskatchewan's case, reponsiblity for licencing and fish management was transferred in 1930 with appropriate provincial legislation and regulations having been put in place.

According to regulations only certain water bodies presently qualify for rainbow trout fish farming. Those are bodies of water which have no outlet and are incapable of sustaining fish populations over winter. The policy is to prevent disease spread in nature.

Fish health and disease is a federal matter but the relative regulations are primarily administered by the provinces. These regulations which apply to live fish are to prevent the spread of infectious diseases through inspection means and control of fish transport.

Aquaculture produce exported or traded inter-provincially is under federal jurisdiction. Produce sold intra-provincially is a provincial matter.

In 1985, Saskatchewan introduced new fish marketing regulations which apply to fish harvested from the wild. Now, commercial fisherman can sell their fish to special dealers and consumers within the province. Special dealers may, in turn, sell fish to retail stores and restaurants. Aquaculture producers are free to sell their fish to anyone in the Province.

Government Role Assessment

Within their respective mandates the federal and provincial governments have shown interest in and done much for the aquaculture industry. However, the following overview suggests their supportive role could be enhanced.

1. In the past three years, the federal government has allocated approximately $7 million to aquaculture. Very little of these funds were used in Saskatchewan.

2. In the past two years, the Saskatchewan government has spent approximately $500,000 on aquaculture. These funds were primarily for technical research, the development of cage rearing of rainbow trout, and the development of hatcheries.

3. Many of the extension services provided by the various departments are perceived to be vague and unco-ordinated resulting in a lack of awareness of services and programs, problems in accessing information and frustration amongst those in the industry.

4. Fish health disease regulations cause concern within the industry, particularily among hatchery operators who fear that the smallest suggestion of a disease in their facility would result in immediate de-certification because of Canada's strict regulations.

5. For the most part, the statutes which affect aquaculture were written for the capture fishery rather than aquaculture. The development of legislation specific to aquaculture is considered desirable by those in the industry.

6. Comprehensive statistics for the industry are limited making it difficult to evaluate developments within the industry.

7. Available government assistance programs seem limited and the industry has made small use of the programs available. The private sector lending institutions perceive the industry as a high risk area because of the type of collateral available as security.

III. HISTORY OF DEVELOPMENT

Aquaculture in Saskatchewan comprises the production of rainbow trout, both fingerlings and table size fish.

Extensive trout farming has been practiced since 1970. It features spring stocking of imported fingerlings which feed on natural freshwater shrimp and other invertebrates growing to table size for fall harvest.

By 1975 there were more than 2,500 fish farming licences issued to hobby and commercial fish farmers. The commercial licence allowed the farmer to sell his product. The number of licences issued declined to 1,753 in 1981. Since then, there has been resurgence with 2,323 licences issued in 1985.

In 1976 estimated production of rainbow trout reached an historical high of 131 tonnes. Since that time annual production volumes have declined somewhat as did the numbers of fish farmers. The recent opening of northern water bodies within the Northerns Provincial Forest area to aquaculture production has widened the geographical range and increased the production opportunities of the industry. In 1985, production was estimated at 100 tonnes.

The number of commercial licences issued has been consistently less than 3% of the total number of licences issued, which is an increase from the relatively constant number between 45 and 60 issued from 1976 - 1982 to 93 in 1985. Despite the small number of commercial licences, they account for a disproportionate share of the total harvest. As an example, commercial farmers harvested approximately 20% of the total

catch in 1975 and 1976, rising to 31.5% in 1982. Similarily production per commercial licence has been on average, ten times that for private or hobby licences. In 1976 the ratio was 435 kg. to 45 kg.

Current Situation

Considerable interest has been shown recently in more intensive forms of aquaculture. Two primary areas of interest are the commercial production of trout fingerlings and experimentation in grow-out operations such as cage/tank rearing and cage rearing.

Currently, five commercial hatcheries are in operation, three of which have completed a season of production. The hatchery operators hope to replace the annual importation of 500,000 to 700,000 fingerlings (mainly from South Dakota). As well, they hope to supply future intensive "grow-out" operations and a perceived government market. To date, there has been some displacement of imports by the local hatcheries. It remains to be determined whether local hatcheries can compete with import fingerlings in terms of size, quality and price.

Seven cm. fingerlings were most often stocked in the early 1970's. A decade later the majority of fingerlings stocked were 10 cm. in size. This has contributed to the relative reduction in numbers of fingerlings stocked.

Experimental projects in cage culture appear to have met with some success in producing fish of consistent quality and size. Some technical problems relating to security, survival and disease remain to be

resolved. No commercial-scale tank or raceway rearing projects have been reported to date but interest has been expressed.

Constraints to extensive production of farmed trout include low recovery rates among commercial fish farmers related to predators, summerkill, stocking mortality, poaching and personal limitations of time and labour. Other limiting factors mentioned in a study survey of commercial fish farmers related to the "lack of information", lack of financial assistance, and the policy of limiting extensive aquaculture to shallow winter-kill bodies of water. A majority opinion was expressed that production capability is a greater limitation to the industry in Saskatchewan than marketing problems. However, there is clear objective evidence of marketing difficulties by successful producers.

Concerns voiced by surveyed operators or others active in fingerling production have to do with:

1. need for one co-ordinating or regulating body,
2. large number of hatcheries entering production within a short period of time,
3. need for improved advisory services, both in business planning and in technical operations,
4. economic viability of hatcheries at current scale,
5. high costs of imported feed from Ontario,
6. maintaining a reliable source of eggs, especially for those capable of two or more production cycles, and
7. displacement of Alberta markets by similar hatcheries being established in Alberta in the future.

The sixth point, the source of egg supply, is of particular concern. With the loss of certification of the Mt. Lassen operation in California, rainbow trout eggs have been in short supply in Canada. Alternative sources in Ontario have been accessed with some success. The solution, the development of a brood stock in Saskatchewan is not likely to be attempted by hatchery operators due to stringent disease control standards and considerable financial risk at the low production volume in Saskatchewan.

Marketing of trout relies primarily on word-of-mouth and informal advertising. A few producers have had success in marketing to retail outlets. The limited production season of extensive fish farmers is the key constraint to an increase in this market. Only a handful of commercial farmers (10-15) receive significant cash income from the sale of rainbow trout. However, these account for 80-90% of the trout produced. For the remainder, the sale of trout is secondary to recreational aspects of the industry.

To the vast majority of fish farmers, trout farming is a hobby, a recreational activity and a source of dietary supplement to be shared with family and friends. This observation applies not only to the 2,000 plus hobbyists, but also to the majority of holders of commercial licences who reported no sales of fish in the 1985 production season. The scale of operations at which virtually all hobby and most commercial fish farmers operate is too small to generate much income to the individual or family, even if they were able or willing to market all fish produced. It is estimated that the employment generated by commercial fish farmers in 1985 was in the range of 55 to 65 person months of employment. This based on the 10 to 15 commercial fish farmers

who sold their products. Development of the five commercial hatcheries, it is estimated, will have created between 50 and 60 person months of direct employment in 1986. This excludes employment generated through construction, but includes the operators. In terms of employment generation, aquaculture appears to be not labour intensive in both the extensive and intensive production modes. As an economic venture, extensive commercial trout farming has a very high degree of inherent risk with repect to variable, unpredictable and generally low rates of recovery.

Manitoba and Alberta

The patterns of aquaculture development in Manitoba and Alberta are similar to Saskatchewan in terms of species produced, mode of production and time frames. Comparative statistics are scarce; Saskatchewan aquaculture, in fact, has more detailed statistical documentation than either Manitoba or Alberta.

Currently, in Manitoba there are approximately 400 hobby fish farmers and 30-40 commercial operators who raise trout for sale. It is estimated that about 25 tonnes of trout is harvested annually by commercial fish farmers.

Manitoba production constraints are similar to those prevailing in Saskatchewan. However, one additional constraint has been identified recently. This consists of a parasite which normally attacks the fish heart but has also been found embedded in flesh. Occurrence of this parasite has been reported for two winterkill lakes. It is presently

believed that bird droppings and intermediate hosting by shrimp may be involved.

Manitoba has relied on fingerlings imported from the United States. In 1982, there were 430,000 fingerlings imported from South Dakota. A private commercial hatchery with a reported production capacity of 200,000 to 300,00 fingerlings per production cycle is now operating at La Broquerie, about 100 km. southeast of Winnipeg.

Currently, experimental production of Arctic char is being undertaken by extensive culture in northern Manitoba lakes. Experimental work with respect to intensive rearing of Arctic char is also taking place using surplus tanks of a Winnipeg malting plant. The Freshwater Institute in Winnipeg is involved in both projects.

Alberta aquaculture consists primarily of extensive culture of rainbow trout. In 1983, licences were issued to about 1,500 private fish farmers and approximately 40 to 50 commercial fish farmers. There is a preference for 15 cm. and larger fingerlings in the province. About 75% of the fingerlings are supplied by one Calgary broker who imports 3.75 cm. fingerlings and grows them out for subsequent sale to fish farmers. It is estimated that 400,000 to 600,000 fingerlings are imported annually.

Annual Alberta production of fish for commercial sale has been estimated at 34 tonnes. A recent development of interest is the pilot project in raceway rearing of trout at Lake Wabamun. The success of this venture is yet undetermined.

Ontario and Quebec

In Ontario there are significant differences in the volume of rainbow trout produced and the production modes used compared to the prairie provinces. The availability of abundant ground water, ancillary supply industries and access to a large urban market present a more favourable supply/demand situation than is present on the prairies.

Estimates of production range from 350 tonnes to 540 tonnes annually around 1980 and 750 tonnes produced in 1983. This is about nine times total prairie production. Approximately 30 commercial fish farmers provide 90% of provincial production while six individual operations represent about half of the total production capacity.

The industry has achieved a high degree of vertical integration in production from brood stock to table fish. In most cases, table sized trout constitute the primary product although fry and fingerlings are also sold for stocking.

In 1983 when approximately 90 commercial licences were issued, it was estimated that there were about 60 full-time and 65 part-time people in the production side of fish farming in Ontario. These statistics suggest that aquaculture in Ontario as in other places, is not a labour intensive activity.

In Quebec, of the 417 commercial breeding permits issued in 1983 for the rearing of trout it appears that about only 35 of these were for "commercial purposes". Commercial production is estimated to be in the order of 350 tonnes annually, comprised of fry, fingerlings and adult

fish raised for stocking, recreational fishing and for human consumption.

Until 1980, production of trout eggs was in government hands. Since then about 30 private producers have become established.

It is estimated that the industry provides between 100 and 150 person/years of employment annually in Quebec.

The aquaculture employment statistics for Ontario and Quebec substantiates low additional employment expectations associated with the development of the industry in Saskatchewan.

East and West Coast

Atlantic Canada in 1982 produced approximately 1,401 tonnes of aquaculture products representing seven species; 195 tonnes was rainbow trout using a variety of production modes. To produce the rainbow trout tonnage involved 19 fish farmers. The value of aquaculture products in Atlantic Canada is only a fraction of the capture fishery ($1.8 million vs. $2 billion).

Aquaculture in British Columbia includes the culture of fin-fish and marine plants. In 1981-82 there were 95 licences issued for growing trout in raceways and ponds. Five of the trout farmers produced 82% of the 1982-82 production. Production in 1982 was 110 tonnes, twice the amount produced in 1975. Some 129 tonnes of Pacific Salmon was produced through aquaculture in 1983.

Saltwater production of rainbow trout is secondary to the fast growing production of salmon. However, since rainbow trout spawn in spring, they have the potential to be part of a rotation with salmon. Currently, new strains of rainbow trout are being developed for saltwater culture.

IV. MARKET ASSESSMENT

The assessment of the market covers the fingerling and the table-size rainbow trout market segments.

Fingerling Market

The five commercial hatcheries in the provinces have an estimated capacity of 1,000,000 to 1,500,000 fingerlings when existing plant is used to full capacity. The present estimated size of their market is as follows:

Private & Commercial Fish Farmers	Fingerlings (000)
Manitoba	400-500
Saskatchewan	600-800
Alberta	400-600

Marketing efforts for fingerlings in Saskatchewan have been aimed primarily at import replacement. The Saskatchewan market potential based on traditional culture methods is for an additional 400,000 to 600,000 fingerlings annually. The Manitoba market would be constrained by transportation costs and competition from a Manitoba hatchery. Alberta potential is based on import replacements in the order of 100,000 to 200,000 fingerlings annually.

The demand for fingerlings for Saskatchewan grow-out production will largely be a function of increased demand for table-size fish. If intensive cage culture rather than extensive operations emerges as the

leading production mode for year-round supply of fish and if near total recovery is achieved, then the incremental demand for fingerlings could be in the order of only 150,000 to 200,000 within 5 years.

Provincial government requirements for stocking of rainbow trout is a variable and unpredictable market. Two of the hatchery operators have successfully secured contracts for a three year experimental stocking program of Redberry Lake, despite established out-of-province suppliers competing very strongly on the basis of price and a proven record of supply. Future requirements for Redberry Lake will depend on the success of this initial program. It is not clear whether the provincial hatchery will be able to supply fingerlings for other lakes to be included in an enlarged fish enhancement program.

Given the total productive capacity of the five Saskatchewan hatcheries it would appear that the demand represented by their potential fingerling market can be adequately handled. It remains to be seen how successful they will be in realizing their full short-term potential. Based on long-term projections presented later in the report, it is likely that expansion of present capacity will be required.

Table Fish Market

The marketing of table-size rainbow trout occurs in all areas of Canada, with the level of marketing activity and the volume of sales in each area varying. The impact of imported rainbow trout, particularly from the United States, is significatnt in all parts of Canada. The following table estimates current sales volume by regions in Canada.

ESTIMATED SALES VOLUMES OF RAINBOW TROUT BY REGION

	PRAIRIE PROVINCES		ONTARIO		ATLANTIC CANADA		QUEBEC		BRITISH COLUMBIA		TOTAL	
	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%
Local Products to:												
- local markets	73.2	63.0	600.0	50.4	170.0	98.8	800.0	84.2	79.5	97.5	1,722.7	68.6
- export	-	-	150.0	12.6	-	-	-	-	-	-	150.0	6.0
Imports	42.9	37.0	440.0	37.0	2.0*	1.2	150.0	15.8	2.0*	2.5	636.9	25.4
Total	116.1	100.0	1,190.0	100.0	172.0	100.0	950.0	100.0	81.5	100.0	2,509.6	100.0
Sales Mix by Region		5.0		47.0		7.0		38.0		3.0		100.0

* estimated

Sales by type of outlet for each of the 3 prairie province are given in the following table.

ESTIMATED CURRENT ANNUAL SALES VOLUMES BY PRAIRIE PROVINCE

OUTLET TYPE	SASKATCHEWAN		MANITOBA		ALBERTA		TOTAL	
	Tonnes	%	Tonnes	%	Tonnes	%	Tonnes	%
Local product direct to consumer	11.3	35.6	18.0	57.1	30.6	58.0	59.9	51.6
Wholesale and retail outlets - local product	3.1	10.0	6.8	21.6	3.4	6.0	13.3	11.5
- import	17.3	57.0	6.7	21.3	18.9	36.0	42.9	36.9
TOTAL	31.7	100.0	31.5	100.0	52.9	100.0	116.1	100.0
TOTAL SALES MIX BY PROVINCE		27.3		27.1		45.6		100.0

It is to be noted that over 50% of Saskatchewan's market volume of 31.7 tonnes is filled by imports and is the highest import percentage of any prairie province. Also, Saskatchewan lags behind Manitoba in the sale of local product through wholesale and retail outlets.

Commercial sales, by province, as a percentage to total prairie sales, generally correspond to each province's population as a percentage of total population.

Published government statistics indicate that for 1983, the production volume for the prairie provinces was 140 tonnes. If this production volume, which includes the hobby fish farmer volumes, and the import volume for the region are added, the result is a total consumption of 182.9 tonnes given that local production approximates consumption. Based on a prairie population of 4,416,000, per capita consumption for the prairies is calculated to be 0.04 kg. This is low and does not compare favorably with the 0.11 kg per capita consumption calculated for Saskatchewan using more detailed information. Without knowing more precisely, production/consumption by private farmers and friends in all prairie provinces, the published per capita consumption figures are open to question and possibly understated. Regardless of accuracy, prairie consumption of rainbow trout is low relative to fish in total and represents a marketing opportunity.

The price received by the commercial fish farmer varies with the province or the region, from $3.85/kg. in Alberta, Manitoba and Ontario to a high of around $6.00/kg. in Quebec and British Columbia. Saskatchewan farmers receive $5.50/kg.

Wholesale prices appear to have a similar pattern to that of prices paid to commercial fish farmers. Wholesale prices range from a low of approximately $6.00/kg. to $7.44/kg. Wholesale prices of imported product from Idaho range from $4.73/kg. to $6.38/kg.

Saskatchewan commercial farmers would have to be price competitive to exploit markets outside the province.

Ontario has progressed further in aquaculture than any other province. Possible reasons for this include close proximity to large market potential, a more temperate climate that is conducive to year-round trout supply and more than adequate ground water supply to meet intensive means of production.

World wide, fish production and sales are stabilizing in those countries where rainbow trout farming is established. At the same time, sales volumes of salmon and other luxury or higher-priced fish such as marine shrimp are on the increase. Generally these countries are considered neither a threat nor an opportunity to the aquaculture industry in Saskatchewan.

The exception is the United States which provides strong competition. However, the impact of this competition can be reduced substantially by the application of good marketing. In general, United States is not considered a particularly attractive market opportunity. The major portion of the U.S. market is controlled by a very small number of large producer/processors who are currently operating in Idaho at 80% of capacity and are able to fill any market gaps. This is not to say that niche marketing is not possible. In the case of Ontario producers, they

have been able to export 150 tonnes annually to the United States, with their advantage of close proximity to densely populated market centers. With Saskatchewan producers and their potential product advantage of a distinctive color, it is possible United States market segments could be penetrated. It is reasoned that market demand could be created at premium prices, given the quality of the product, despite the present inability to supply year-round and a sparsely populated market area in close proximity.

As part of the study, the potential market for provincially produced Arctic char, crayfish and pan-sized salmon was explored. The conclusions reached suggest it is too soon to say whether or not these products present opportunities for Saskatchwewan aquaculture. However, it would appear that all three have market potential to varying degrees and are worthy of further research and investigation. This additional work should address production methods, production costs, harvest results, marketing strategies to develop markets and profit potential.

Opportunities open to the industry in Saskatchewan and the constraints it faces are primarily related to marketing factors and issues.

Fingerling Market Constraints

The following factors in supplying fingerlings were considered important by hatchery operators and their customers.

- Availability of eggs: The marketing success of the hatcheries and, in turn, the commercial fish farmers is predicated on having a continuous assured source of eggs from certified rainbow trout brood stock. In this regard, the provincial industry is vulnerable. To minimize or

eliminate egg supply vulnerability, the industry ideally should have its own in-province brood stock.

- Quality: Trout farmers require vigorous disease-free fingerlings.

- Service: Saskatchewan hatchery operators do have the advantage of being closer to their customers than their United States competitors.

- Supply: The hatchery operators must be able to supply fingerlings at the time and in numbers required by their customers to ensure their successful presence in the market on an ongoing basis.

- Price: Saskatchewan commercial hatcheries are currently meeting the prices of American competitors to gain market share. This may be regarded as a positive approach provided that at least all operating costs are being met, particularily over the long-term.

- Size: The hatchery operator must supply all fingerling sizes requested by the customer. Some complaints on the runting factor have been expressed regarding both the imported and locally produced fingerlings.

- Advertising: Continued advertising to maintain and increase market share is seen as essential.

- Transportation costs: Regardless of transportation costs, delivered prices within Saskatchewan and to other provinces will have to be competitive.

The fingerling market opportunity for the Saskatchewan hatcheries is import replacement and expanded table-size trout production in the three prairie provinces. It is conceivable that, for enhanced viability, the hatcheries in the province could get into intensive grow-out operations. If this were the case and near-total recovery achieved, it could have a dampening effect on fingerlings demand. Currently however, there is no grow-out capacity in the province and the proposed enlargement of the provincial enhancement program could be an offsetting factor.

Table Fish Market Constraints

The following factors were considered important in the marketing of rainbow trout:

1. Supply

   The seasonality of local supply as well as supply sufficiency are the most crucial factors in marketing rainbow trout. As yet, local producers cannot guarantee year-round quality product in either fresh or frozen form.

2. Quality and Quality Assurance

   At present, there is no mechanism in place which ensures that the quality of all rainbow trout produced and sold commercially in Saskatchewan consistently meets the needs of the marketplace. Until this occurs, the full potential of the market will not be achieved.

3. Product Form and Processing

   The Saskatchewan market requires the following sizes of fish:

   1. direct to consumer - 0.5 kg. - 0.7 kg.

ii. restaurants:

meals - 0.22 kg. - 0.25 kg.

lunches - 0.17 kg.

iii. stores - 0.45 kg.

Most locally produced rainbow trout are 0.5 kg. to 0.7 kg. and are larger than the size restaurants purchase. Manitoba, Alberta and Ontario markets also have size requirements which tend to be smaller than the locally produced product.

Currently, very little rainbow trout is processed beyond dressing and rinsing, although some fillets and head-on deboned fish are sold in retail stores. A segment of the market has indicated preference for various processed forms, yet retail stores are not promoting them. Most consumers prefer fresh dressed fish with heads-on although the frozen product is also purchased. The trend to fresh fish and the demand for year-round supply are matters which have not been addressed by the industry in Saskatchewan.

Some interest in canned trout has been identified. However, it is believed that the cost, volume requirements, and regulations involved are deterrents at this time.

A few fish farmers smoke their rainbow trout for home consumption. Retail stores and fish specialty shops have also tried processing and selling of smoked trout but were unsuccessful because the fish had been smoked too much for most consumers. However, interest in lightly smoked rainbow trout is evident in the market. Market demand is also apparent in some areas of Canada for stuffed rainbow trout and rainbow

trout steaks. These are product forms which are not normally available in Saskatchewan retail outlets.

4. Packaging

Many of the farmers are placing the rainbow trout in plastic bags and then freezing them. This type of packaging has no market appeal and the product has a shelf life of only three months because of oxidization. The Saskatchewan Research Council and a few of the fish farmers are vacuum packaging and then freezing the fish which extends the shelf life a further three months. This process has been well received in the market. Another possible approach to packaging involves ice glazing.

No attempt has been made to use packaging advertising as a marketing tool for product identification and promotion to increase the market share.

5. Product Cost

In eastern Canada, fresh rainbow trout produced locally can compete with fresh Idaho rainbow trout primarily because of transportation costs of the imported product and its delivery time which may distract from its freshness. Delivery time and mode are of less consequence to frozen product; hence, the Idaho product is able to compete effectively in frozen form.

In western Canada, Idaho rainbow trout, both fresh and frozen, is a very strong competitor of locally produced rainbow trout. However, if market demand were stronger and larger volumes of local product were available, larger shipments may reduce the unit cost of transportation

and allow local rainbow trout to be priced more competitively against the imported product. For Saskatchewan producers to market effectively, they would have to meet a price of $3.85/kg. F.O.B. Manitoba and Alberta, and 3.96/kg. F.O.B. Ontario unless product superiority that could command higher prices will be established.

6. Marketing Body

In both British Columbia and Idaho, a few farmers are producing the majority of rainbow trout and essentially control the industry, both in production and sales. These farmers do the marketing of their product as well as producing and processing.

In Ontario, again, a few farmers produce the majority of rainbow trout and for the most part, market through a co-operative, while Quebec farmers are required to sell their product to a union for further marketing.

In the prairie provinces, there is no one farmer that can control the production and market as in B.C. or Idaho, at least not regularly from year to year.

The most extensive or best organized marketing of locally produced rainbow trout on the prairies has been through brokers in Manitoba and Alberta. Considering the time and skills needed to market effectively, leaves most prairie rainbow trout producers vulnerable when they produce large volumes. If the industry is to grow in Saskatchewan fish farmers need to be market driven, which requires some form of organized marketing, be it through a co-operative, an independent broker, or a lead producer/processor.

7. Promotion/Education

With effective marketing, it is believed the level of rainbow trout consumption can be increased. The level of consumption has the potential to rise with increased interest in health and diets. Also, more and more consumers are interested in a wider variety of foods such as fish, which are now widely available in supermarkets in a variety of forms.

Given this potential for greater consumption, more advertising and promotion is necessary to achieve greater demand and consumer awareness and loyalty for a premium product produced locally, partly by educating the consumers with respect to the benefits of eating fish and its ease of preparation.

8. Market Research

As far as can be determined, market research relative to aquaculture and specifically to rainbow trout is performed only by government in Canada. Research such as this study is sporadic in occurrence and lacks in accuracy due to market statistics that are neither comprehensive nor consistent. Good market planning requires on-going market research and reliable statistics upon which to plan. These needs must be met by government and the industry.

The development of a strategy for the Saskatchewan industry requires an examination of alternative ways to address these marketing factors and issues. This examination in the final analysis requires the involvement of the aquaculture industry.

V. RECOMMENDED STRATEGY

The assessment of the trout market suggests that an opportunity exists for relatively substantial growth in the volume of table size fish sold by the Saskatchewan aquaculture industry. The opportunity relates to three potential areas. These are:

- increased per capita consumption,
- import replacement in the 3 prairie provinces and Ontario, and
- new markets such as catch-n-pay operations and possible export to the United States.

Exploiting the identified opportunities to the fullest is, however, contingent on an underlying strategy that the industry must become market driven. The strategy is predicated on the assumption that the availability of required eggs to the provinces hatcheries and, in turn, fingerlings to commercial fish farmers are assured.

Fingerling Market Projection

On the basis of the proposed strategy being implemented, total annual sales of fingerlings and table size rainbow trout have been projected for two time frames: annual sales by the end of the fifth year, the short term and annual sales by the end of the tenth year, the long-term. The projections are as follows:

TIME	TOTAL ANNUAL FINGERLING SALES
By the Fifth Year (000)	1,250 - 1,560
By the Tenth Year (000)	1,880 - 2,180

The projections are based on the assumptions that of the table size trout sold commercially, 68% will be sold by intensive type operations with the remainder coming from extensive operations achieving a 40% recovery. In addition, it is assumed market share will be gained in Alberta, but not Manitoba, and that annual sales to the Saskatchewan government of 200,000 - 500,000 fingerlings is a reasonable estimate.

The present hatchery capacity of the province should present no problem in meeting the short term projections. It is likely that expansion of capacity will be required to meet long-term projections.

Table Fish Market Projection

Volume projections for table size trout are as follows;

TIME	TOTAL ANNUAL SALES
By the Fifth Year (tonnes)	56
By the Tenth Year (tonnes)	196

In the first five years the main marketing effort would be concentrated in the prairie provinces to establish a solid base before concentrating a marketing thrust in Ontario and the United States. The latter are mature markets and perceived as more competitive. They should be approached with a pilot project to establish the concept of "Saskatchewan Quality".

The projections are ambitous relative to Saskatchewan producers but it must be acknowledged that the 56 tonnes represents less than the production of any one of the six largest Ontario producers.

Complete import replacement on the prairies is not considered realistic but majority replacement may be possible. Although prices in Manitoba and Alberta are lower than in Saskatchewan it can be argued that if the Saskatchewan industry is to grow, competitive pricing, where needed, is essential and that this market force will result in the necessary production efficiencies. This is what being market driven means.

Ontario resistance is possible but Saskatchewan's marketing emphasis must stress that market share in Ontario will be gained at the expense of import replacement. It is reasoned that achieving 25% of Idaho import sales (110 tonnes) is achievable without serious repercussions as the volume involved is less than 1% of total marketable product available from the U.S.

Projected sales to the United States are based on selling only trout grown in extensive waters. With the preferred pink colour and assurance of acceptable taste it is believed that the fish can be sold as a distinctive Canadian (Saskatchewan) product at a premium price.

Currently, although it has much to offer in a way of life and enjoyment, commercial fish farming is treated as a secondary activity rather than a primary business where commitment and a disciplined approach to all facets of the operation including marketing are prerequisites. So far, the industry's resources and emphasis have been spent on production. If it is the industry's goal to grow and be more successful, this emphasis must include marketing and dedication to a disciplined approach. The projections reflect these prerequisites.

Working from the foregoing premise, the supporting strategies which evolve are centred upon meeting the requirements of consumers and implementing the marketing actions necessary to meet these requirements. Consumer requirements are fourfold:

- year-round continuity of supply in the quantities required, preferably fresh,
- timely service,
- quality product packaged in the sizes and form demanded, and
- competitive prices where value for the dollar spent is perceived.

Both extensive and intensive modes of production will be in play even though there are still technical production problems, such as winter aeration, to be resolved to demonstrate in the province what has been proven feasible elsewhere. Resolution of these matters is well within the reach of present technology.

The most likely way of meeting all consumer requirements is by intensive farming. In this regard the potential intensive fish farmer may already be an existing extensive farmer, one or more of the hatchery operators, or newcomers to the industry with the necessary capital, expertise and drive.

Meeting consumer requirements is within the grasp of the industry and, attainable, provided that parallel marketing factors are met. The required factors are as follows:

- a knowledgeable marketing group,
- market intelligence,

- marketing plan,
- quality assurance,
- group advertising and promotion, and
- funding

The industry currently is not organized to properly address market opportunities. There are three possible solutions: a leading producer/ processor, a broker or a co-operative marketing group. Of the three alternatives a co-operative approach appears to offer the greatest promise, given that the body is bonded together by common goals and has the resources, strength and marketing expertise needed. There is precedent for the co-operative alternative based on the experience of fish farmers in Idaho and Ontario.

It is further reasoned that a market group such as a co-operative can do a better job than individuals acting on their own behalf, in keeping informed on the market place and the forces at play, developing plans to explore market opportunities and growth, including advertising, promotion plans and quality assurance. In the case of quality assurance, the matter is simplified if product processing falls under the control of the marketing group with a central group-owned and operated processing plant, as in the case of the Ontario co-operative. It is envisaged that the facility would be available to any member fish farmer wishing to use it, provided that the product meets quality standards.

The market sales volumes projected are not large and will unfortunately limit marketing effort, particularly in the early years of operation. Solutions to this problem could include allowing for operating expenses when capitalizing the marketing group and initial assistance from

Saskatchewan Economic Development and Trade, Tourism and Small Business and DRIE.

Two types of funding are required: capital funds for the development of processing/marketing/infrastructure and operating funds. Preliminary calculations indicate estimated capital costs of $300,000. Ongoing operating funds must be generated from sales. It is estimated that the group will have to cover $50,000 to $200,000 in operating costs annually, based on the short and long-term sales projections.

The industry is presumably represented by two fingerling producer/ distributor associations in the province. It is important that the proposed co-operative be comprised of serious market orientated industry members and co-exist with present associations in a fashion similar to that in Ontario.

Government in general has a continuing role covering fish health protection, the control of sanitation in fish handling and wild stock protection. In addition, the government has a supportive role in the development of aquaculture in the private sector. However, lead role, initiative and drive to develop the industry further must come from those in the industry who benefit directly. The degree to which supportive government initiatives are pursued and taken should depend on the initiatives taken by the private sector, or elements of it, to organize and develop some plan for going forward. It is the responsibility of the private sector, not government, to make it happen.

It is clear that an industry initiator is required to mobilize steps to take advantage of market opportunities. It is not clear whether the initiator required is already in the industry or not. Certainly from the standpoint of vested interest, the hatchery operators appear to have sufficiant cause to be the initiator and to stimulate the industry into a market driven force.

Recommended actions by government in general to address the proposed strategy include the following:

1. Consider ways and means to improve and increase the transfer of technology between government sources and the provincial aquaculture industry; estimated costs, no more than $75,000 per year.

2. Support the establishment of a provincial rainbow trout brood stock. If this requires a new separate facility, capital costs are estimated at $100,000. Annual operating costs are estimated at $80,000. A portion of this cost would be recovered from egg sales. The incremental cost of providing this service at the Provincial Hatchery may be less. If involvement of the Provincial Hatchery is not feasible, endeavour to involve SRC facilities. It is unlikely the private sector will develop the brood stock due to stringent disease control standards and considerable financial risk at the low production volume in Saskatchewan.

3. Continue to support and or perform technical aquaculture research. Areas of consideration include brood stock, production systems and disease control.

4. Improve and standardize the aquaculture statistical data base.

5. Relieve FFMC from all responsibility for the marketing of rainbow trout, leaving it entirely in the hands of the private sector.

6. Develop new aquaculture legislation and policy to increase access to a wider range of water bodies including selected non-winterkill lakes, to include other species and to accommodate the rights of both extensive fish farmers and the public.

7. Consider the merits of making available more comprehensive aquaculture courses for all fish farmers to be carried out under existing programs.

8. Increase extension services to assist aquaculture producers. The services would include areas such as technical assistance, water quality assessment, fish health and diagnostic services, nutrition and operations and business managment advice.

9. Convene a meeting of industry participants and others with a vested interest to discuss this report with a view to determining the level of interest in the industry regarding growth and any initiatives that will be taken in this regard.

Any significant initiative on the part of government cannot be justified in terms of the magnitude of the opportunity represented by provincial exports, provincial import replacement or job creation. Rather, justification for any initiative and industry support must be defined in terms of improving the viability of the industry as it is presently

constituted and continuance of the personal satisfaction and enjoyment of farmers and friends that is derived from aquaculture.

In the case of the private sector, it is assumed that a marketing interest group, large or small, or individual, will emerge from the recommended meeting to be convened by the provincial government. Given that this group or person emerges, the following major recommendations are proposed.

1. Form a small Steering Committe of three to five persons.

2. Develop an action plan to address marketing strategy further, assess the co-operative approach, visit the Ontario co-operative (financial assistance by government), discussions with brokers/special dealers, determination of operating costs, determination of capital costs and the development of a financing plan.

3. Report back to the interest group as a whole and make recommendation regarding business form, ownership cost and processing plant availability or requirements.

4. Decide at a subsequent meeting whether to proceed or not.

5. If the decision is not to proceed as initially perceived, discuss possible alternative approaches.

6. If the decision is to proceed, make the necessary arrangements to incorporate, elect a Board of Directors, and carryout a membership drive to raise the amount of equity required.

7. Define the respective roles of the Board and the marketing manager.

8. Make application for government financial assistance.

9. Establish banking arrangements and confirm the availability of required loans.

10. Recruit a marketing manager once the financing plan is in place.

11. Have the marketing manager develop the detailed operating action plan.

The foregoing actions will probably require a year to execute and action should be initiated as soon as possible to take advantage of any momentum created by the decision to act. It is not unreasonable to think in terms of being fully operational by late fall 1987 and, at the latest, by spring of 1988.